Testimony to the California Energy Commission on Potential Effects of Land Subsidence to Natural Gas Pipelines

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Outline

- PG&E Risk Management Program
- Subsidence Impact and Response
- El Nido Basin Case Study
- Next Steps

- Updates of weather-related and outside force threat databases, including subsidence, using latest publicly available and in-house data.

- Collect and review data to make informed risk assessments.

- Prioritization of the risk informs response, which can include studies to better quantify threats and risk, leading to monitoring or mitigation.

ASME B31.8S A9.5

- *"Prevention activities are most appropriate for this threat."*
- *"If a pipeline falls within the listed susceptibilities, line patrolling should be used to perform surface assessments. In certain locations, such as known slide areas or areas of ongoing subsidence, the progress of the movement should be monitored."*

Subsidence – PG&E Actions

PG&E is aware of subsidence documented in the Central Valley and has been proactive in our response:

1. Reached out to DWR and USGS to discuss subsidence data, implications and possible collaborations for monitoring

2. Obtained InSAR datasets (2007-2011, 2014-2015) from NASA JPL to conduct internal assessments

3. Convened a team to develop a strategy to assess and monitor our assets in subsidence zones

4. Conducting a pilot assessment study targeting the area of greatest potential impact

Assets Potentially Impacted – Subsidence

NASA JPL data 6/2007 – 1/2011

Transmission Pipe

San Joaquin Valley

- -0.5 to -1.0 ft
- > -1.0 to -1.5 ft
- > -1.5 to -2.0 ft
- > -2.0 to -2.5 ft
- > -2.5 to -3.0 ft
- > -3.0 ft

Assets Potentially Impacted – Subsidence

NASA JPL data 5/2014 – 1/2015

Transmission Pipe

San Joaquin Valley

- < -0.5 ft
- -0.5 to -1 ft
- > -1 to -1.5 ft

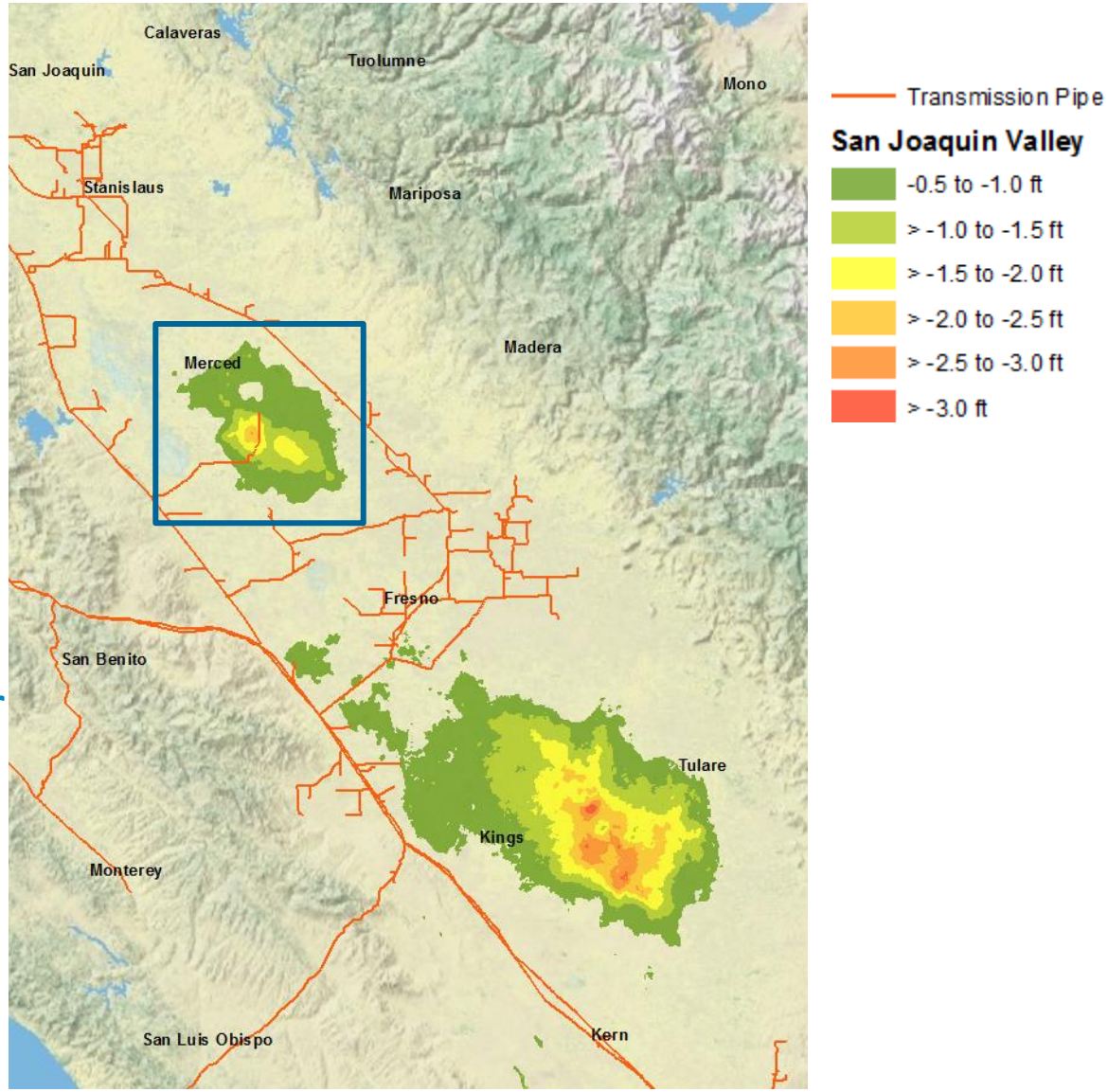
Sacramento Valley

- < -0.5 ft

El Nido Basin Pilot Study

- Area of focused subsidence based on 2007-2011 data source.
- PG&E gas transmission line crosses northwest subsidence lobe.
- Line is part of a pilot study to assess whether subsidence has a significant impact on transmission lines.

NASA JPL data 6/2007 – 1/2011



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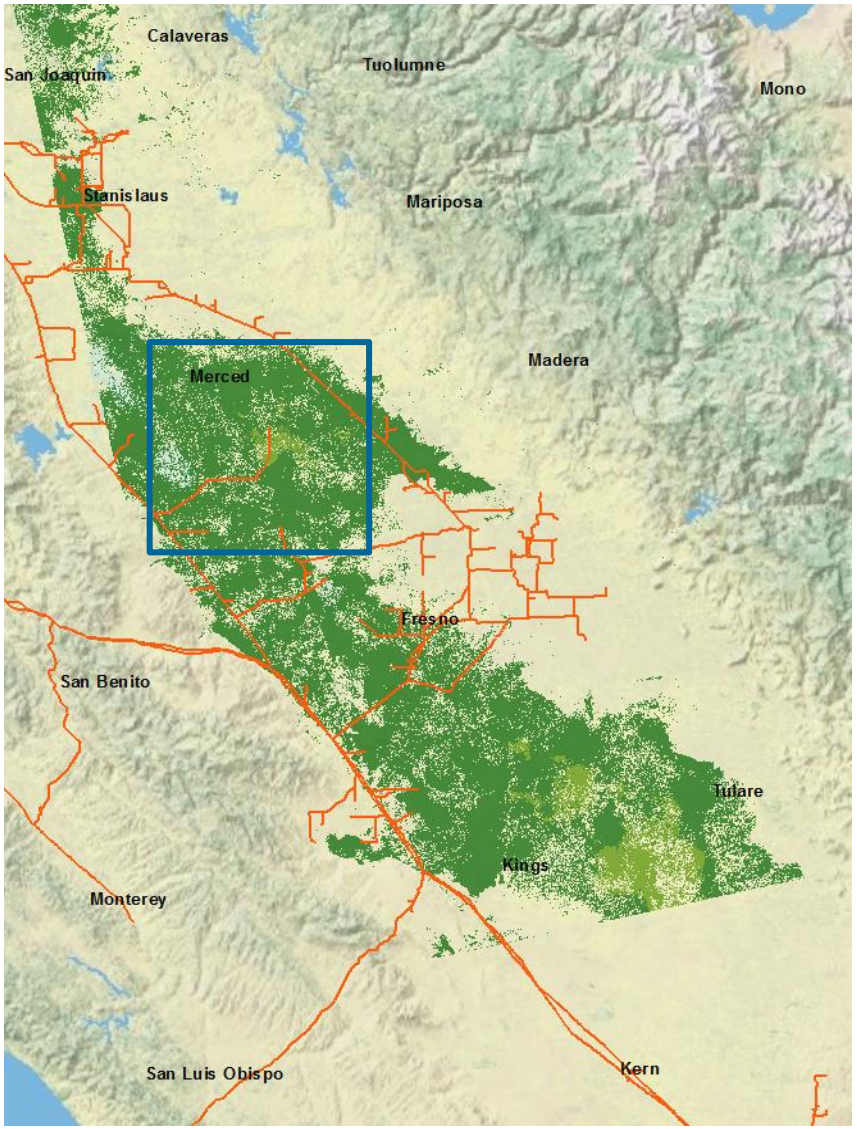
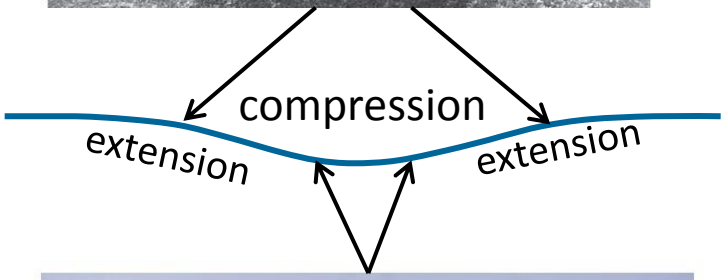


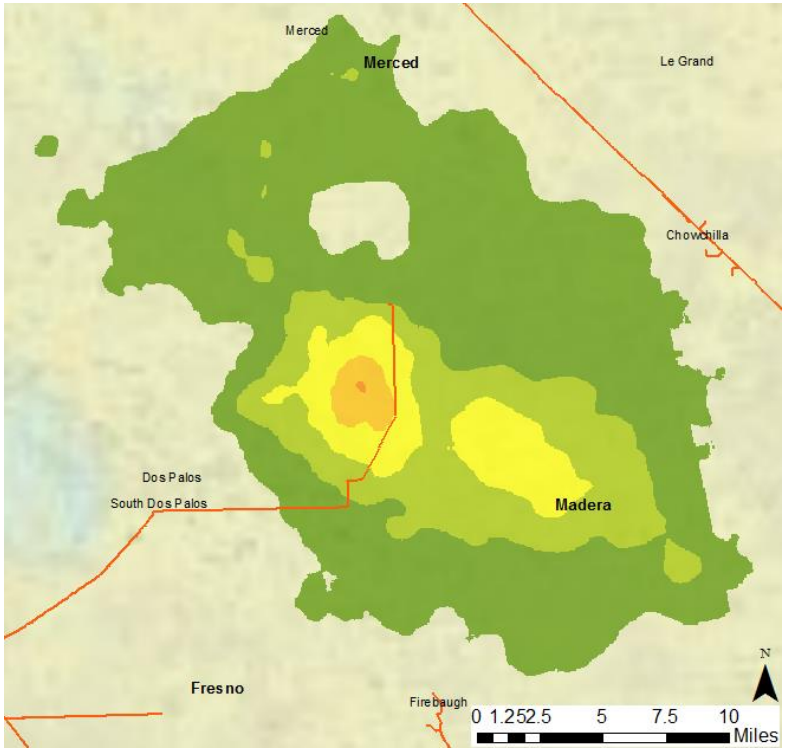
El Nido Basin – Potential Deformation Pattern

EXTENSIONAL FAULTING OR FISSURING



COMPRESSIONAL BUCKLING

NASA JPL data 6/2007 – 1/2011



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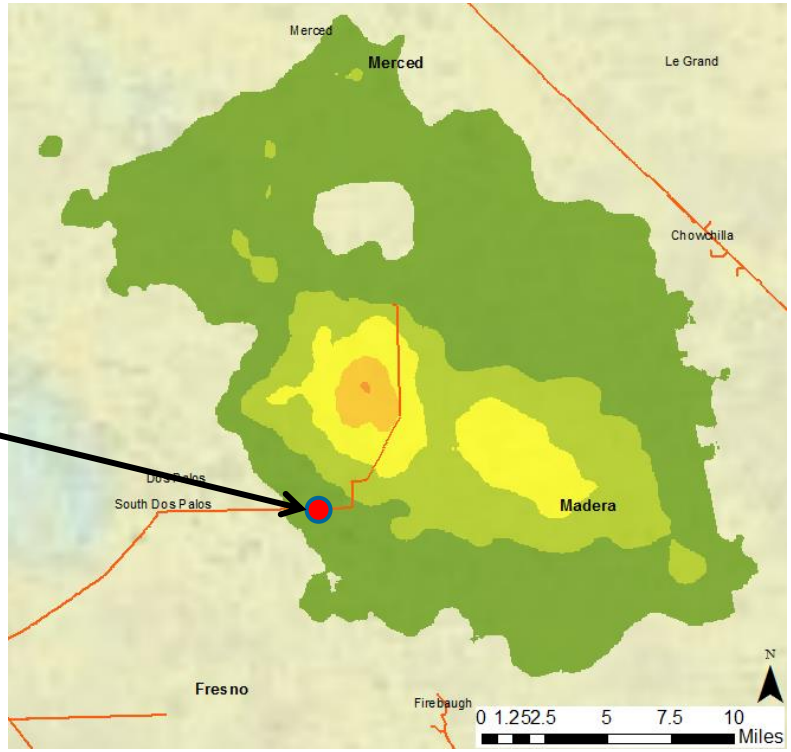
El Nido Basin - Pipeline Evaluation - Effect on Infrastructure

NASA JPL data 6/2007 – 1/2011



Transmission Pipe

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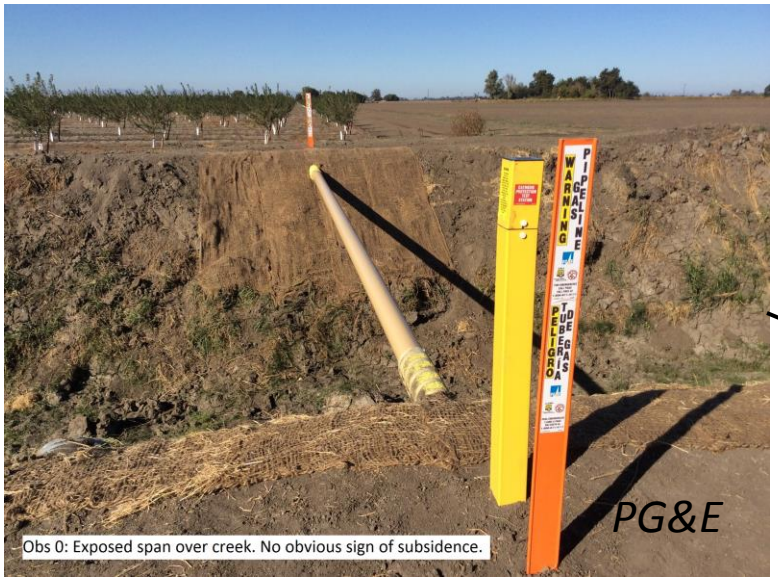
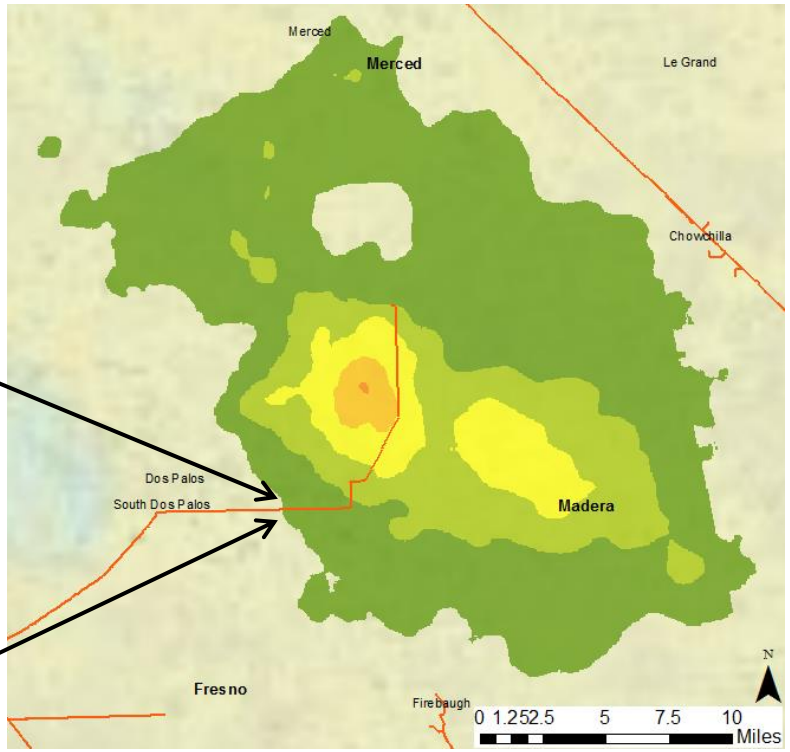
El Nido Basin - Pipeline Evaluation



Obs 0: Exposed span over creek. No obvious sign of subsidence.

Obs 0 (2): Looking East from exposed span

NASA JPL data 6/2007 – 1/2011



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Subsidence – Next Steps

- Continue to work with Federal and State agencies to obtain latest available subsidence data, and for at risk areas, collaboration on monitoring efforts
- Perform pipeline integrity modeling to better understand impact of subsidence on gas transmission lines in subsidence zone
- Conduct risk informed monitoring and implement mitigation efforts

Subsidence – Next Steps

PG&E supports the Department of Water Resources' recommendations contained in its 2014 report, "Summary of Recent, Historical, and Estimated Potential for Future Land Subsidence in California."

- "Future monitoring efforts should build off this initial work, incorporate the results of the NASA-JPL InSAR assessment of the Central Valley, integrate site-specific lithology data, and include updated groundwater level, extensometer, and continuous GPS data."

- "The recommendations from the comprehensive review of subsidence completed by LSCE, Borchers and Carpenter (2014) should also be considered for future subsidence work in California and include:

  Monitor land surface elevation changes and compaction
  - Remote surveillance and analysis: InSAR and continuous GPS
  - Ground surveillance and analysis: Surveying and borehole extensometry

  Characterize aquifer system and monitor groundwater levels
  Collect, store and disseminate data
  Evaluate and prioritize subsiding groundwater basins"

http://www.waterplan.water.ca.gov/docs/groundwater/update2013/content/appendecies/GWU2013_Apdx_F_Final.pdf